

I CLAIM:

1. A method for repairing and/or generating and/or regenerating myocardium and/or myocardial cells comprising the administration of somatic stem cells.
- 5 2. The method of claim 1, wherein the administered somatic stem cells are adult stem cells.
- 10 3. The method of claim 1, wherein the administered somatic stem cells are cardiac stem cells.
4. The method of claim 1, wherein the administered somatic stem cells are adult cardiac stem cells.
5. The method of claim 1, wherein the administered somatic stem cells are cardiac stem cells and stem cells of another type other than cardiac stem cells.
6. The method of claim 1, wherein the administered somatic stem cells are adult cardiac stem cells and stem cells of another type other than adult cardiac stem cells.
7. The method of claim 1, wherein the administered somatic stem cells are cardiac and hematopoietic stem cells.
8. The method of claim 1, wherein the administered somatic stem cells are adult cardiac and adult hematopoietic stem cells.
- 25 9. The method of claim 1, wherein the somatic stem cells are lineage negative.
- 30 10. The method of claim 9, wherein the lineage negative somatic stem cells are *c-kit*<sup>POS</sup>.

11. The method of claim 1, wherein a therapeutically effective dose of somatic stem cells are delivered to the heart.
12. The method of claim 11, wherein the therapeutically effective dose of the somatic stem  
5 cells is  $2 \times 10^4 - 1 \times 10^5$  cells.
13. The method of claim 11, wherein the therapeutically effective dose is delivered to the border area of the damaged myocardium.
- 10 14. The method of claim 11, wherein the therapeutically effective dose is administered by injection.
15. The method of claim 13, wherein the therapeutically effective dose is injected intramyocardially.
16. The method of claim 15, wherein the therapeutically effective dose is injected trans-epicardially or transendocardially.
17. The method of claim 16, wherein with the trans-endocardial approach a catheter-based approach is used.
18. The method of claim 13, wherein the administered somatic stem cells migrate into the damaged myocardium.
- 25 19. The method of claim 18, wherein the delivered somatic stem cells differentiate into one or more of the following types of cells selected from the group consisting of:
  - a. myocytes;
  - b. smooth muscle cells; and
  - c. endothelial cells.
- 30 20. The method of claim 19, wherein the differentiated somatic stem cells proliferate.

21. The method of claim 19, wherein the differentiated somatic stem cells assemble into myocardium and/or myocardial cells.
- 5 22. The method of claim 19, wherein the differentiated somatic stem cells assemble into a coronary artery.
23. The method of claim 19, wherein the differentiated somatic stem cells assemble into an arteriole.
- 10 24. The method of claim 19, wherein the differentiated somatic stem cells assemble into a capillary.
25. The method of claim 19, wherein the differentiated somatic stem cells at least partially restore structural and functional integrity to the damaged myocardium and/or myocardial cells.
26. A method of repairing and/or generating and/or regenerating recently damaged myocardium and/or myocardial cells comprising the administration of a cytokine.
27. The method of claim 26, wherein the cytokine comprises a cytokine selected from the group consisting of:
- a. a stem cell factor;
  - b. a granulocyte-colony stimulating factor;
  - 25 c. a stromal cell-derived factor-1;
  - d. an interleukin-3;
  - e. a granulocyte-macrophage colony stimulating factor;
  - f. a macrophage colony stimulating factor;
  - g. a steel factor;
  - 30 h. a vascular endothelial growth factor;
- and combinations thereof.

28. The method of claim 27, wherein a therapeutically effective dose of a cytokine is administered.
- 5 29. The method of claim 28, wherein the therapeutically effective dose of the cytokine is 50-500 µg/kg per day.
30. The method of claim 28, wherein the therapeutically effective dose is injected.
- 10 31. The method of claim 30, wherein the therapeutically effective dose is injected subcutaneously.
32. The method of claim 30, wherein the therapeutically effective dose is injected intravenously.
33. The method of claim 28, wherein the therapeutically effective dose stimulates the patient's own somatic stem cells.
34. The method of claim 33, wherein the stimulated somatic stem cells are adult stem cells.
35. The method of claim 33, wherein the stimulated somatic stem cells are hematopoietic stem cells.
- 25 36. The method of claim 33, wherein the stimulated somatic stem cells are adult hematopoietic stem cells.
37. The method of claim 33, wherein the stimulated somatic stem cells are cardiac stem cells.
38. The method of claim 33, wherein the stimulated somatic stem cells are adult cardiac stem cells.
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39. The method of claim 33, wherein the stimulated somatic stem cells are cardiac stem cells and stem cells of another type of stem cell other than cardiac stem cells.
40. The method of claim 33, wherein the stimulated somatic stem cells are adult cardiac stem cells and stem cells of another type of stem cell other than adult cardiac stem cells.
41. The method of claim 33, wherein the stimulated somatic stem cells are cardiac and hematopoietic stem cells.
42. The method of claim 33, wherein the stimulated somatic stem cells are adult cardiac and adult hematopoietic stem cells.
43. The method of claim 33, wherein the stimulated somatic stem cells become mobilized.
44. The method of claim 43, wherein the mobilized somatic stem cells home to the damaged myocardium and/or myocardial cells.
45. The method of claim 43, wherein the mobilized somatic stem cells migrate into the damaged myocardium and/or myocardial cells.
46. The method of claim 44, wherein the somatic stem cells differentiate into one or more of the following types of cells selected from the group consisting of:
- a. myocytes;
  - b. smooth muscle cells; and
  - c. endothelial cells.
47. The method of claim 46, wherein the differentiated somatic stem cells proliferate.
48. The method of claim 46 wherein the differentiated somatic stem cells assemble into myocardium and/or myocardial cells.

49. The method of claim 46, wherein the differentiated somatic stem cells assemble into a coronary artery.
50. The method of claim 46, wherein the differentiated somatic stem cells assemble into an arteriole.
51. The method of claim 46, wherein the differentiated somatic stem cells assemble into a capillary.
52. The method of claim 46, wherein the differentiated somatic stem cells at least partially restore function to the damaged myocardium and/or myocardial cells.
53. A method of repairing and/or generating and/or regenerating recently damaged myocardium and/or myocardial cells comprising the administration of somatic stem cells and a cytokine.
54. The method of claim 53, wherein the administered somatic stem cells are adult stem cells.
55. The method of claim 53, wherein the administered somatic stem cells are hematopoietic stem cells.
56. The method of claim 53, wherein the administered somatic stem cells are adult hematopoietic stem cells.
57. The method of claim 53, wherein the administered somatic stem cells are cardiac stem cells.
58. The method of claim 53, wherein the administered somatic stem cells are adult cardiac stem cells.

59. The method of claim 53, wherein the administered somatic stem cells are cardiac stem cells and stem cells of another type of stem cell other than cardiac stem cells.
60. The method of claim 53, wherein the administered somatic stem cells are adult cardiac stem cells and stem cells of another type of stem cell other than adult cardiac stem cells.
61. The method of claim 53, wherein the administered somatic stem cells are cardiac and hematopoietic stem cells.
62. The method of claim 53, wherein the administered somatic stem cells are adult cardiac and adult hematopoietic stem cells.
63. The method of claim 53, wherein the administered somatic stem cells are lineage negative.
64. The method of claim 63, wherein the administered lineage negative somatic stem cells are *c-kit*<sup>POS</sup>.
65. The method of claim 53, wherein a therapeutically effective dose of somatic stem cells is delivered to the heart.
66. The method of claim 65, wherein the therapeutically effective dose of the somatic stem cells is  $2 \times 10^4 - 1 \times 10^5$  cells.
67. The method of claim 65, wherein the therapeutically effective dose is administered by injection.
68. The method of claim 67, wherein the therapeutically effective dose is injected minitramyocardially.

69. The method of claim 67, wherein the therapeutically effective dose is injected trans-epicardially or transendocardially.
70. The method of claim 69, wherein with the trans-endocardial approach a catheter-based approach is used.
71. The method of claim 53, where in the cytokine comprises a cytokine selected from the group consisting of:
- a. a stem cell factor;
  - b. a granulocyte-colony stimulating factor;
  - c. a stromal cell-derived factor-1;
  - d. an interleukin-3;
  - e. a granulocyte-macrophage colony stimulating factor;
  - f. a macrophage colony stimulating factor;
  - g. a steel factor;
  - h. a vascular endothelial growth factor;
- and combinations thereof.
72. The method of claim 71, wherein a therapeutically effective dose of a cytokine is administered.
73. The method of claim 72, wherein the therapeutically effective dose of the cytokine is 50-500 µg/kg per day.
74. The method of claim 72, wherein the therapeutically effective dose is injected.
75. The method of claim 74, wherein the therapeutically effective dose is injected subcutaneously.
76. The method of claim 74, wherein the therapeutically effective dose is injected intravenously.



77. The method of claim 74, wherein the therapeutically effective dose stimulates the patient's somatic stem cells.
- 5 78. The method of claim 77, wherein the stimulated somatic stem cells are mobilized.
79. The method of claim 77, wherein the stimulated somatic stem cells home to the damaged myocardium and/or myocardial cells.
- 10 80. The method of claim 79, wherein the somatic stem cells migrate into the damaged myocardium and/or myocardial cells.
81. The method of claim 80, wherein the somatic stem cells differentiate into one or more of the following types of cells selected from the group consisting of:
- a. myocytes;
  - b. smooth muscle cells; and
  - c. endothelial cells.
82. The method of claim 81, wherein the differentiated somatic stem cells proliferate.
83. The method of claim 82, wherein the differentiated somatic stem cells assemble into myocardium and/or myocardial cells.
84. The method of claim 82, wherein the differentiated somatic stem cells assemble into a coronary artery.
- 25 85. The method of claim 82, wherein the differentiated somatic stem cells assemble into an arteriole.
- 30 86. The method of claim 82, wherein the differentiated somatic stem cells assemble into a capillary.

87. The method of claim 82, wherein the differentiated somatic stem cells at least partially restore structural and functional integrity to the damaged myocardium and/or myocardial cells.

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88. A pharmaceutical composition comprising a therapeutically effective amount of somatic stem cells.

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89. The pharmaceutical composition of claim 88, wherein the administered somatic stem cells are adult stem cells.

90. The pharmaceutical composition of claim 88, wherein the administered somatic stem cells are hematopoietic stem cells.

91. The pharmaceutical composition of claim 88, wherein the administered somatic stem cells are adult hematopoietic stem cells.

92. The pharmaceutical composition of claim 88, wherein the administered somatic stem cells are cardiac stem cells.

93. The pharmaceutical composition of claim 88, wherein the administered somatic stem cells are adult cardiac stem cells.

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94. The pharmaceutical composition of claim 88, wherein the administered somatic stem cells are cardiac stem cells and stem cells of another type of stem cell other than cardiac stem cells.

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95. The pharmaceutical composition of claim 88, wherein the administered somatic stem cells are adult cardiac stem cells and stem cells of another type of stem cell other than adult cardiac stem cells.

96. The pharmaceutical composition of claim 88, wherein the administered somatic stem cells are cardiac and hematopoietic stem cells.
97. The pharmaceutical composition of claim 88, wherein the administered somatic stem cells are adult cardiac and adult hematopoietic stem cells.
98. The pharmaceutical composition of claim 88, wherein the therapeutically effective dose of the somatic stem cells is  $2 \times 10^4 - 1 \times 10^5$  cells.

99. A pharmaceutical composition comprising a therapeutically effective amount of somatic stem cells and a cytokine comprising a cytokine selected from the group consisting of:

- a. a stem cell factor;
- b. a granulocyte-colony stimulating factor;
- c. a stromal cell-derived factor-1;
- d. an interleukin-3;
- e. a granulocyte-macrophage colony stimulating factor;
- f. a macrophage colony stimulating factor;
- g. a steel factor;
- h. vascular endothelial growth factor;

and combinations thereof.

100. The pharmaceutical composition of claim 99 wherein the therapeutically effective dose of the cytokine is 50-500  $\mu\text{g/kg}$  per day.
101. A composition comprising a therapeutically effective amount of somatic stem cells.
102. The composition of claim 101, wherein the administered somatic stem cells are adult stem cells.

103. The composition of claim 101, wherein the administered somatic stem cells are hematopoietic stem cells.
104. The composition of claim 101, wherein the administered somatic stem cells are adult hematopoietic stem cells.
105. The composition of claim 101, wherein the administered somatic stem cells are cardiac stem cells.
106. The composition of claim 101, wherein the administered somatic stem cells are adult cardiac stem cells.
107. The composition of claim 101, wherein the administered somatic stem cells are cardiac stem cells and stem cells of another type of stem cell other than cardiac stem cells.
108. The composition of claim 101, wherein the administered somatic stem cells are adult cardiac stem cells and stem cells of another type of stem cell other than adult cardiac stem cells.
109. The composition of claim 101, wherein the administered somatic stem cells are cardiac and hematopoietic stem cells.
110. A method of implanting or depositing cells or causing the implantation or depositing of somatic stem cells in cardiac or blood vessel tissue comprising administration of somatic stem cells.
111. The method of claim 110, wherein the administered somatic stem cells are adult stem cells.
112. The method of claim 110, wherein the administered somatic stem cells are hematopoietic stem cells.

113. The method of claim 110, wherein the administered somatic stem cells are adult hematopoietic stem cells.
- 5 114. The method of claim 110, wherein the administered somatic stem cells are cardiac stem cells.
115. The method of claim 110, wherein the administered somatic stem cells are adult cardiac stem cells.
- 10 116. The method of claim 110, wherein the administered somatic stem cells are cardiac stem cells and stem cells of another type other than cardiac stem cells.
117. The method of claim 110, wherein the administered somatic stem cells are adult cardiac stem cells and stem cells of another type other than adult cardiac stem cells.
118. The method of claim 110, wherein the administered somatic stem cells are cardiac and hematopoietic stem cells.
119. The method of claim 110, wherein the administered somatic stem cells are adult cardiac and adult hematopoietic stem cells.
120. The method of claim 110, wherein the somatic stem cells are lineage negative.
- 25 121. The method of claim 120, wherein the lineage negative somatic stem cells are *c-kit*<sup>POS</sup>.
122. The method of claim 110, wherein a therapeutically effective dose of somatic stem cells are delivered to the heart.
- 30 123. The method of claim 110, wherein the therapeutically effective dose of the somatic stem cells is  $2 \times 10^4 - 1 \times 10^5$  cells.

124. A method of implanting or depositing cells or causing the implantation or depositing of somatic stem cells in cardiac or blood vessel tissue comprising administration of a cytokine.

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125. The method of claim 124, wherein the cytokine comprises a cytokine selected from the group consisting of:

- i. a stem cell factor;
- j. a granulocyte-colony stimulating factor;
- 10 k. a stromal cell-derived factor-1;
- l. an interleukin-3;
- m. a granulocyte-macrophage colony stimulating factor;
- n. a macrophage colony stimulating factor;
- o. a steel factor;
- p. a vascular endothelial growth factor;

and combinations thereof.

126. The method of claim 124, wherein a therapeutically effective dose of a cytokine is administered.

127. The method of claim 126, wherein the therapeutically effective dose of the cytokine is 50-500 µg/kg per day.

128. The method of claim 126, wherein the therapeutically effective dose stimulates the patient's own somatic stem cells.

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129. The method of claim 128, wherein the stimulated somatic stem cells are adult stem cells.

130. The method of claim 128, wherein the stimulated somatic stem cells are hematopoietic stem cells.

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131. The method of claim 128, wherein the stimulated somatic stem cells are adult hematopoietic stem cells.
- 5 132. The method of claim 128, wherein the stimulated somatic stem cells are cardiac stem cells.
133. The method of claim 128, wherein the stimulated somatic stem cells are adult cardiac stem cells.
- 10 134. The method of claim 128, wherein the stimulated somatic stem cells are cardiac stem cells and stem cells of another type of stem cell other than cardiac stem cells.
135. The method of claim 128, wherein the stimulated somatic stem cells are adult cardiac stem cells and stem cells of another type of stem cell other than adult cardiac stem cells.
136. The method of claim 128, wherein the stimulated somatic stem cells are cardiac and hematopoietic stem cells.
137. The method of claim 128, wherein the stimulated somatic stem cells are adult cardiac and adult hematopoietic stem cells.
138. The method of claim 128, wherein the stimulated somatic stem cells become mobilized.
- 25 139. The method of claim 138, wherein the mobilized somatic stem cells home to the damaged myocardium and/or myocardial cells.
140. The method of claim 138, wherein the mobilized somatic stem cells migrate into the damaged myocardium and/or myocardial cells.
- 30 141. The composition of claim 101, wherein the administered somatic stem cells are adult cardiac and adult hematopoietic stem cells.

142. The composition of claim 101, wherein the therapeutically effective dose of the somatic stem cells is  $2 \times 10^4 - 1 \times 10^5$  cells.

5 143. A composition comprising a therapeutically effective amount of somatic stem cells and a cytokine comprising a cytokine selected from the group of:

- i. a stem cell factor;
- j. a granulocyte-colony stimulating factor;
- 10 k. a stromal cell-derived factor-1;
- l. an interleukin-3;
- m. a granulocyte-macrophage colony stimulating factor;
- n. a macrophage colony stimulating factor;
- o. a steel factor;
- p. vascular endothelial growth factor;

and combinations thereof.

144. The composition of claim 112 wherein the therapeutically effective dose of the cytokine is 50-500  $\mu\text{g/kg}$  per day.

145. A pharmaceutical composition for use in the treatment, therapy or prevention of cardiovascular disease or related complaint.

146. A pharmaceutical composition for use in repairing and/or generating and/or regenerating recently damaged myocardium and/or myocardial cells.

147. A kit comprising a pharmaceutical composition of claims 88 or 99 for use in the treatment, therapy or prevention of cardiovascular disease or related complaint.



148. A kit comprising a pharmaceutical composition of claims 88 or 99 for use in repairing and/or generating and/or regenerating recently damaged myocardium and/or myocardial cells.
- 5 149. A kit comprising somatic stem cells and optionally a cytokine for the treatment, therapy or prevention of cardiovascular disease or related complaint.
150. A kit for preparing pharmaceutical compositions of claims 88 or 99.
- 10 151. A method of making pharmaceutical compositions of claims 88 or 99.
152. A method of making compositions of claim 101 or 112.
153. A method of treating damaged myocardium and/or myocardial cells comprising the steps of:
- a. harvesting somatic stem cells;
  - b. *in vitro* culturing of the harvested somatic stem cells in conjunction with heart tissue, optionally in the presence of a cytokine;
  - c. *in vitro* differentiation of the somatic stem cells into myocytes, smooth muscle cells and endothelial cells;
  - d. *in vitro* proliferation of differentiated cells and formation of tissue;
  - e. *in vitro* assembly of differentiated cells and/or tissue into cardiac structures, including coronary arteries, arterioles, capillaries, and myocardium.
  - f. implanting the cultured somatic stem cells, tissue, or cardiac structures into the heart.
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